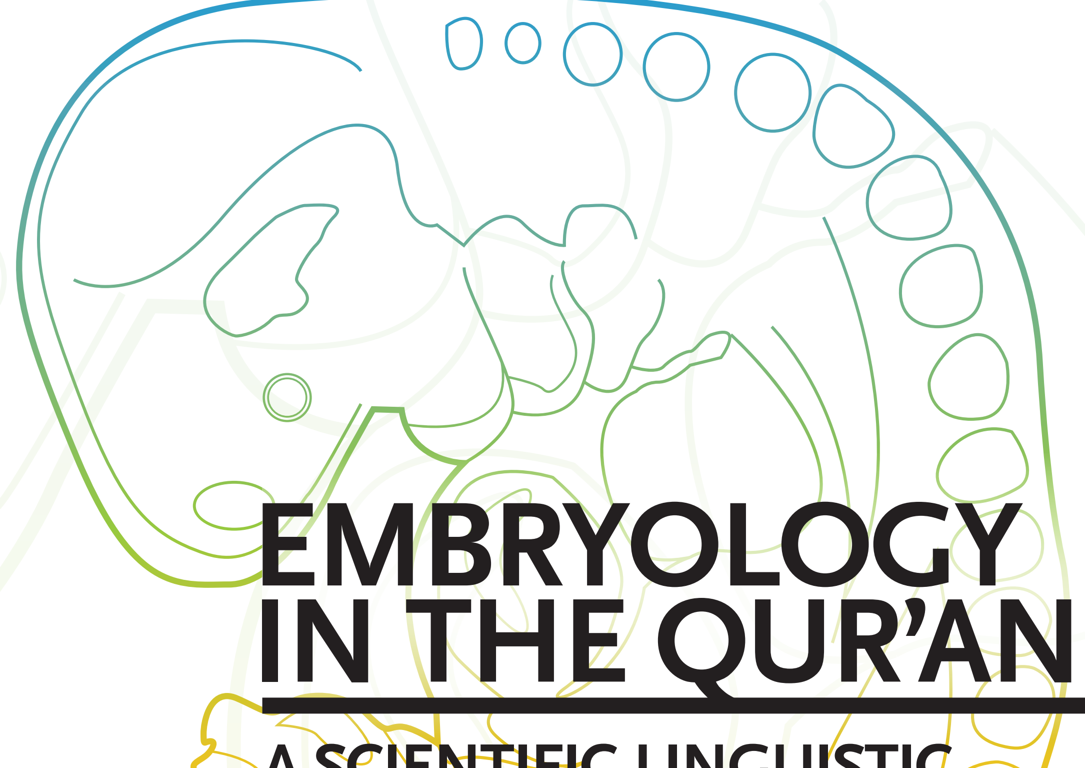


EMBRYOLOGY IN THE QUR'AN

A SCIENTIFIC-LINGUISTIC ANALYSIS OF CHAPTER 23

WITH RESPONSES TO HISTORICAL, SCIENTIFIC & POPULAR CONTENTIONS



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ABSTRACT

This paper is an analysis of chapter 23 verses 12 to 14 of the Qur'an in light of modern embryology. This study will provide a linguistic breakdown of the relevant verses and correlate these linguistic items to modern science. To ensure a comprehensive understanding of this study, an overview of qur'anic exegesis will be provided to appreciate how the Qur'an is made accessible and intelligible to the reader. This study will also address various contentions, which attempt to challenge the credibility of the qur'anic discourse and its concurrence with modern embryology. Among these responses will be a refutation of both the ancient Greek plagiarisation thesis and the accusation that al-Harith bin Kalada, a 7th century physician, was the source of the Prophet's ﷺ medical knowledge.

In chapter 23 verses 12 to 14 the Qur'an provides eight meaningful points describing the process of the developing human embryo:

We created man from an essence of clay, then We placed him as a drop of fluid in a safe place. Then We made that drop of fluid into a clinging form, and then We made that form into a lump of flesh, and We made that lump into bones, and We clothed those bones with flesh, and later We made him into other forms. Glory be to God the best of creators. [1]

WHAT IS THE QUR'AN?

Linguistically the word Qur'an means 'reading' and came to be referred to as 'the text which is read'. The Qur'an also calls itself *al-kitab*, which lexically implies a written book. Thus the significance of writing, reading and reflecting upon the Qur'an has been emphasised from the very beginning of Islam. The qur'anic material is divided into *suwar*[2], meaning 'chapters' in Arabic. According to the historian Phillip Hitti, the collected written text of the Qur'an is one of the youngest epoch-making books and the most widely read book ever written.[3]

The Qur'an is the supreme authority in Islam as it is the fundamental and essential source of the Islamic creed, ethics, laws, and guidance. For Muslims, the Qur'an is of Divine origin. It is the speech of the Creator and not the word of the Prophet Muhammad ﷺ[4]. Rather, it was revealed to him, and through him to mankind, in word and meaning. Az-Zarqani, a 9th century scholar of the Qur'an, summarises the description of the book. He writes:

The Qur'an is the Arabic speech of God, which He revealed to Muhammad ﷺ in wording and meaning, and which has been preserved in the compiled written pages of the Qur'an, and has reached us by recurrent reporting.[5]

THE SCIENCE OF QUR'ANIC EXEGESIS

The Qur'an, like any other legislative and spiritual book, requires exegesis. Qur'anic exegesis, known as *tafsir* in Arabic, is essentially the knowledge through which one increases an understanding of the Qur'an and a comprehension of its commandments and wisdom.[6] Qur'anic exegesis is a branch of knowledge dealing with ***"the method of the delivery of the words of the Qur'an, their interpretation, their individual and composite forms and expediencies."*** [7] It is this science by which the Qur'an is understood, its meanings explained and its rulings derived. Thus the Qur'an is made accessible and intelligible to the reader.

What follows are the sources of qur'anic exegesis used by exegetes to interpret the Qur'an:

1. THE QUR'AN: The first source of exegesis is the Qur'an itself. Many verses in the Qur'an complement and clarify the meaning of other verses[8]. This use of intertextuality is considered significant in the study of linguistics[9]. The following is an example of the Qur'an explaining itself through relevant verses:

a. ***"The path of those you have favoured"*** is here unexplained but then elaborated upon in a verse elsewhere in the Qur'an. [10] [See below]

b. ***"Those whom God has favoured, such as the Prophets, loyal persons, martyrs and honourable men. How fine are such companions"***

2. THE PROPHETIC TRADITIONS: The second source is the traditions of the Prophet Muhammad ﷺ.[12] The Qur'an often mentions the Prophet's ﷺ role of expounding upon the Qur'an in word and deed. [13]

3. THE STATEMENTS OF THE COMPANIONS: The third source is the explanations of the companions of the Prophet ﷺ, who learnt the Qur'an directly from him. Many of them devoted their entire lives to studying the Qur'an, its exegesis and related knowledge. [14]

4. THE ARABIC LANGUAGE: Another source of exegesis is the Arabic language in which the Qur'an was revealed. A verse is interpreted using the Arabic language as a tool for analysis if the other sources do not offer an interpretation.

SCIENCE IN THE QUR'AN

The Qur'an's relationship with science has been discussed for centuries, with scholars debating whether to use science as an exegetical tool to elucidate its meanings. The 14th Century scholar Al-Shatibi was against using science. He argues the Qur'an is a religious book which is mainly focused on the manifestation of the Divine will in the human sphere of existence. Al-Shatibi writes:

Many people have overstepped all bounds and made undue claims about the Qur'an when they assigned to it all types of knowledge of the past and the present such as the natural sciences, mathematics and logic. [15]

However, the 11th Century theologian and philosopher, Al-Ghazali advocates using science to elucidate the meanings of the Qur'an. Al-Ghazali views the Qur'an as providing the foundations to all types of knowledge. He states, for example, that all knowledge is implied ***"in the signs and indications in the Qur'an"*** [16] and in his book *The Jewels of the Qur'an* he argues that the principles of various sciences ***"are not outside the Qur'an."*** [17]

Scholars also claim the Qur'an is an intrusive text engaging with the inner dimensions of man. Communicative strategies employed by the Qur'an to achieve this include the technique of asking questions and referring to sign-posts to God i.e. its allusions to the natural world. There are an estimated 750 verses concerning science and natural phenomena.[18]

Science, as defined by the philosopher Bertrand Russell, is ***"the attempt to discover, by means of observation and reasoning based upon it, ...particular facts about the world, and the laws connecting facts with one another..."***[19]

Although there is no consensus over the definition of science, it seems that Russell's definition applied to the Qur'an offers an array of verses pointing to scientific study. Some examples include:

And who created all things and made them to an exact measure.[20]

We shall show them Our signs in every region of the earth and in themselves, until it becomes clear to them that this is the Truth.[21]

There truly are signs in the creation of the heavens and the earth, and in the alternation of the night and day, for those with understanding.[22]

In the creation of the heavens and earth; in the alternation of the night and day; in the ships that sail the seas with goods for people; in the water which God sends down from the sky to give life to the earth when it has been barren, scattering all kinds of creatures over it; in the changing of the winds and clouds that run their appointed courses between the sky and earth: there are signs in all of these for those who use their minds.[23]

This, however, does not imply the Qur'an is a book of science; rather it is a book of *ayaat*, which is commonly interpreted as 'verses' and linguistically conveys various meanings, such as: sign, proof, evidence and miracle.[24] Thus, the qur'anic verses pertaining to the natural world are not meant to provide detailed descriptions of nature, but they encourage thinking and reflection.

Moreover, the Islamic creedal position maintains that the Qur'an does not negate established realities, and there is a scholarly consensus that its statements pertaining to the natural world are not confined to a 7th century understanding of nature. This is explained by Shaykh Mohar Ali in his book *The Qur'an and the Orientalists*:

Far from reproducing or reflecting the erroneous world-view prevailing in the seventh century Arabia, the Qur'an indeed goes far beyond the scientific knowledge of the time and speaks of scientific facts and truths that have only recently been discovered by man.[25]

In considering this, the fact that a 7th century document contains statements rejecting the established scientific assertions of its time, and complying with modern-day science and its discoveries, makes evident the nature of the Qur'an as a sign-post to the transcendent. This encourages contemplation, and facilitates the arrival at a conclusion that God is One and qur'anic discourse is Divine.

This paper will take one of these signs found in chapter 23 verses 12 to 14, and provide a linguistic breakdown correlating each key word with modern embryology.

ANALYSIS OF CHAPTER 23 VERSES 12 – 14

The Qur'an provides a concise and eloquent account of the developing human embryo.

وَلَقَدْ خَلَقْنَا ٱلْإِنسَٰنَ مِن سُلَٰلَةٍ مِّن طِينٍ

ثُمَّ جَعَلْنَٰهُ نُطْفَةً فِى قَرَارٍ مَّكِينٍ

ثُمَّ خَلَقْنَا ٱلنُّطْفَةَ عَلَقَةً فَخَلَقْنَا ٱلْعَلَقَةَ مُضْغَةً فَخَلَقْنَا

ٱلْمُضْغَةَ عِظَٰمًا فَكَسَوْنَا ٱلْعِظَٰمَ لَحْمًا ثُمَّ أَنشَأْنَٰهُ خَلْقًا ءَاخَرَ

فَتَبَارَكَ ٱللَّهُ أَحْسَنُ ٱلْخَٰلِقِينَ

We created man from an essence of clay, then We placed him as a drop of fluid in a safe place. Then We made that drop of fluid into a clinging form, and then We made that form into a lump of flesh, and We made that lump into bones, and We clothed those bones with flesh, and later We made him into other forms. Glory be to God the best of creators. [26]

1.ESSENCE/EXTRACT OF CLAY

وَلَقَدۡ خَلَقۡنَا ٱلۡإِنسَٰنَ مِن سُلَٰلَةٖ مِّن طِينٖ

We created man from an essence of clay

This verse mentions that the first stage of the human-developmental process is that man is formed from an 'essence' or 'extract' of clay.[27]

The classical exegetes of the Qur'an understood the words *sulaalatin min tin* (an essence of clay) to specifically refer to Adam. These exegetes include the famous 13th century scholar from Cordoba, al-Qurtubi[28]; the 9th Century Persian historian and scholar, al-Tabari[29]; and the 12th century Iraqi physician and historian al-Baghdadi.[30]

Significantly, other exegetes suggest these words refer to the essential elements of the human body, which consist of various chemical components found in clay. Both meanings are intelligible and therefore either can be adopted.

SCIENTIFIC INTERPRETATION

By applying a scientific analysis to this verse it becomes clear that this stage appertains to certain essential chemical components. It is significant that these chemical components are found in clay. They include: Oxygen, Carbon, Hydrogen, Nitrogen, Calcium, Phosphorus, Potassium, Sulfur, Chlorine, Sodium, Magnesium and Silicon; all of which are required for human functioning and development [31]

This is explained by the jurist and exegete Shafi Usmani in his eight volume exegesis of the Qur'an. He writes:

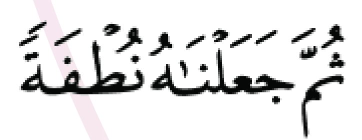
The words sulaalah means 'extract' and tin means 'wet earth' or 'clay' and the verse means that man was created from some special elements extracted from earth.[32]

THE HUMAN BODY IS NOT MADE OF CLAY?

Contemporary critics state that the Qur'an is inaccurate concerning the development of the human being, as the human body is not made from clay. This argument stems from a misunderstanding of the Arabic language, as the key word allowing for the above interpretation is *sulaalah* (extract). This clearly indicates that it is not clay from which the human is created but an extract of clay, which alludes to the necessary chemical components required for human life.

SUMMARY The *sulaalatin min tin* stage: the essential elements required for human life and functioning, found in clay.

2. DROP OF FLUID



then We placed him as a drop of fluid

The next stage of the development of the human embryo is *nutfah*. This word has various meanings:

1. By looking at the Arabic language, it can mean a dribble, a trickle, a drop or semen[33]. *Nutfah* can also mean a singular entity which is a part of a bigger group of its kind. Therefore, a *nutfah* could be a single sperm from a collection of millions of sperms contained in semen, or a single female egg from a group of many other eggs in the Ovaries.[34]

2. According to Prophetic tradition, the Prophet Muhammad ﷺ explained the *nutfah* as a combination of liquids ***"from a male nutfah and from a female nutfah"***.[35]

3. In the Qur'an the *nutfah* is described as a combination of mingled *(al-amshaj)* fluids: ***"We created man from a drop (nutfah) of mingled fluid."*** [36]

This verse, from a grammatical perspective, portrays an image of the *nutfah* as an entity made up of a combination of fluids coming from the mother and the father. The word *al-amshaj* (mingled) is a plural adjective and it is used here with the singular noun *nutfah*. Grammatically, this highlights the verse's concept of *nutfah* as being a single entity or drop produced by a combination of substances.

SCIENTIFIC INTERPRETATION

The principles put forward by both the Qur'an and the Prophetic tradition coincide with what is known today of modern embryology. The *nutfah* stage specifically implies the process of fertilisation, which requires the 'mingling' of components from the mother and the father. These components form a single cell known as the zygote. In regard to this, embryologists John Allen and Beverley Kramer state:

The human individual arises from the conjugation of two minute structures called cells, one from the mother (oocyte) and one from the father (spermatozoon). These are called gametes. Together, these gametes form a single cell, the zygote, from which the entire embryo, including its surrounding membranes, grows. [37]

From a physiological perspective, each one of the two cell structures from both the mother and the father need to be contained in fluids necessary for fertilization. The spermatozoon is contained in fluid called semen[38], and the oocyte is coated in oviductal secretions required for its viability and fertilizability. Physiologists Bruce Koeppen and Bruce Stanton explain:

Oviductal secretions coat and infuse the cumulus-oocyte complex and may be required for viability and fertilizability.[39]

Thus, the analysis of the word *nutfah* as a mingled entity formed as a result of single cells from the mother and the father (which are contained in fluids necessary for fertilization) corresponds with the physiological description of the zygote's formation.

SUMMARY The *nutfah* stage: The formation of the zygote, via the mingling of two fluids from the mother and the father, which contains two small cell structures (the oocyte and the spermatozoon).

ARISTOTLE, GALEN & NUTFAH

The stages of the developing human embryo described in the Qur'an have been examined by some commentators. They assert that the qur'anic discourse on human development is plagiarised from the works of the ancient Greek philosopher and polymath Aristotle, and the 2nd century philosopher and physician Galen. In light of the above analysis this allegation is baseless, as Aristotle believed only the male produces fluid responsible for the development of the embryo (the genetic material). He supposes the male semen to be the active form and the female ovum as providing only the passive element for fertilization; an idea contradictory to modern embryology.

In fact, Aristotle was of the opinion that semen mixed with women's menstrual blood, coagulating to form the embryo. Aristotelian accounts of human development are evidently incongruous with both the Qur'an and modern embryology, as illustrated in his own writings:

***...the female, though it does not contribute any semen to generation... contributes something, viz., the substance constituting the menstrual fluid... [I]f the male is the active partner, the one which originates the movement, and the female qua female is the passive one, surely what the female contributes to the semen of the male will be not semen but material. And this is in fact what we find happening; for the natural substance of the menstrual fluid is to be classed as prime matter.*[40]**

Classical exegetes of the Qur'an convey the disagreement between Aristotelian accounts of human development and the qur'anic narrative. Ibn al-Qayyim, the 14th century jurist and commentator of the Qur'an, uses various Prophetic traditions to emphasise the fact that male semen alone is not responsible for generating a child.[41] Furthermore, assertions of plagiarism are futile as the words used in the Qur'an are unlike Aristotle's choice of words; the Qur'an is scientifically accurate and Aristotle is not. Aristotle's discredited supposition (of menstrual blood being involved in the process of fertilisation) is further contrasted with the Qur'an and its use of the word *nutfah*, which is not the word for menstrual blood in Arabic. The word for menstrual blood in Arabic is *haydh*.

Contrary to this, the Qur'an describes the *nutfah* as a mingled drop or fluid from both the male and the female, not just the male. It also stresses both the male and female as being responsible for the child's genetic makeup. This reasoning is further supported by Prophetic tradition with the Prophet ﷺ affirming a woman's responsibility for the genetic makeup of her child, as he proposes the question: ***"How else do their children resemble them?"***[42] Ibn al-Qayyim theorizes that if women do not have a type of semen, then their children would not look like them. The male semen alone does not generate a child because conception only occurs upon the mixture of male sperm with another equivalent (ovum) from the female. [43]

The assertion that the Qur'an plagiarised from Galen is due to similarities between the Qur'an and the physician's description of the process of fertilisation. In his book *On Semen* Galen states that both the male and the female contribute to the formation of the embryo - implying that they are both responsible for its genetic make-up. [44] However, it must be highlighted that similarity doesn't imply plagiarism, and any such accusation requires evidence. The only possible practical link between the views of Galen (and the other sources of Greek medicine) is the 7th century physician al-Harith bin Kalada. However, this assertion has been proven to be baseless (*see Was al-Harith bin Kalada the source of the Prophet's medical knowledge?*). In absence of a formal link between Greek medicine and the Prophet Muhammad ﷺ, the claim of plagiarisation remains speculative and conspiratorial. This is further substantiated by the fact that knowledge of Galen's views on the developing human embryo were not popularised in 7th century Arabia.

These contrasts and explications contribute to a dismantling of the plagiarisation thesis, and it becomes necessary to pose the questions: If the Prophet ﷺ plagiarised Aristotle's work, why are the words used by Aristotle and the Qur'an to describe this stage dissimilar? And why is the Qur'an scientifically accurate when Aristotle is not? Concerning Galen, why can't we find any practical link between Galen's view on the developing human embryo and the Prophet Muhammad ﷺ?

3. IN A SAFE PLACE



in a safe place

The next stage in the process of human development is *qararin makin*. The word *qararin* means to make sedentary, to establish, to assign, to schedule, to determine, to stipulate, to regulate and to decide; and it carries the further meanings of to confirm, to establish and to affirm.[45] The word *makin* has meanings that include to place, to put/set down firmly and to put in position.[46] The combination of these two words provide connotations of: in a safe place, in a place firmly fixed, in a safe lodging and in a firm resting place.

SCIENTIFIC INTERPRETATION

The terms used by the Qur'an at this stage coincide with modern embryology. The zygote divides into a ball of cells with an outer shell to form the blastocyst. Studies in embryology assert that around the 6th day after fertilization the blastocyst implants itself securely into the uterine wall. Embryologists John Allen and Beverley Kramer explain the process of implantation:

Implantation begins at about the 6th to 7th day after fertilization. The part of the blastocyst projecting into the uterine cavity remains relatively thin. The syntrophoblast contains a proteolytic enzyme which causes destruction of the endometrial cells so that that the blastocyst sinks deeper and deeper into the uterine mucosa...The final deficiency in the endometrium is sealed off by a blood or fibrin clot, overlying the blastocyst. This cover is called the operculum. By about 10 to 12 days after fertilization, the blastocyst is completely encased in the endometrium and thus, implantation is complete.[47]

The analysis of the words *qararin makin*, reflect modern developments in embryology. The meanings offered by the combination of the words *qararin makin* depict the blastocyst sinking 'deeper and deeper' and the sealing off of the endometrium with a 'fibrin clot' ensuring the blastocyst is 'completely encased'.

SUMMARY The *qararin makin* stage: The blastocyst sinking in the endomentrium, being completely encased i.e. the process of implantation.

4. A CLINGING FORM

ثُمَّ خَلَقْنَا ٱلنُّطْفَةَ عَلَقَةً

Then We made that drop of fluid into a clinging form

The Qur'an describes the next stage of the developing human embryo with the word `*alaqah*. This word carries various meanings including: to hang, to be suspended, to be dangled, to stick, to cling, to cleave and to adhere. It can also mean to catch, to get caught, to be affixed or subjoined.[48] Other connotations of the word `*alaqah* include a leech-like substance, having the resemblance of a worm; or being of a 'creeping' disposition inclined to the sucking of blood. Finally, its meaning includes clay that clings to the hand and thick, clotted blood - because of its clinging together. [49]

SCIENTIFIC INTERPRETATION

As defined by modern embryology, the myriad of meanings for the word `*alaqah* correspond to various stages of the embryo's development. Comparisons can be drawn between qu'ranic and scientific depictions of the embryo's appearance and its relationship with the womb. According to modern embryology, from day 15 the embryo is hanging or suspended via the 'connecting stalk' [see Figure 1] and it obtains nutrients through contact with the maternal blood vessels. This description bears a striking resemblance to the picture painted by the word `*alaqah* – a 'hanging' or 'suspended' substance, obtaining nutrients from its host's blood.

Following this, during the 4th week, two processes occur: the formation of the brain and the spinal cord, known as neurulation; and the initial stages of the folding of the embryo. It is upon the culmination of these two processes that the embryo resembles a leech-like form suggested by the word `*alaqah* – a creeping, leech or worm-like substance [see Figure 2, 3 and 4].

HANGING/SUSPENDED

Embryologists Barry Mitchell and Ram Sharma explain the 'hanging' or 'suspended' aspects of the `*alaqah* stage. They describe the embryo as being, ***"connected to the cytotrophoblast by a connecting stalk of extra-embryonic mesoderm (primitive connective tissue). The stalk is the forerunner of the umbilical cord."*** [50]

Figure 1 shows the embryo connected to the cytotrophoblast via a connecting stalk, as if it were hanging or suspended.

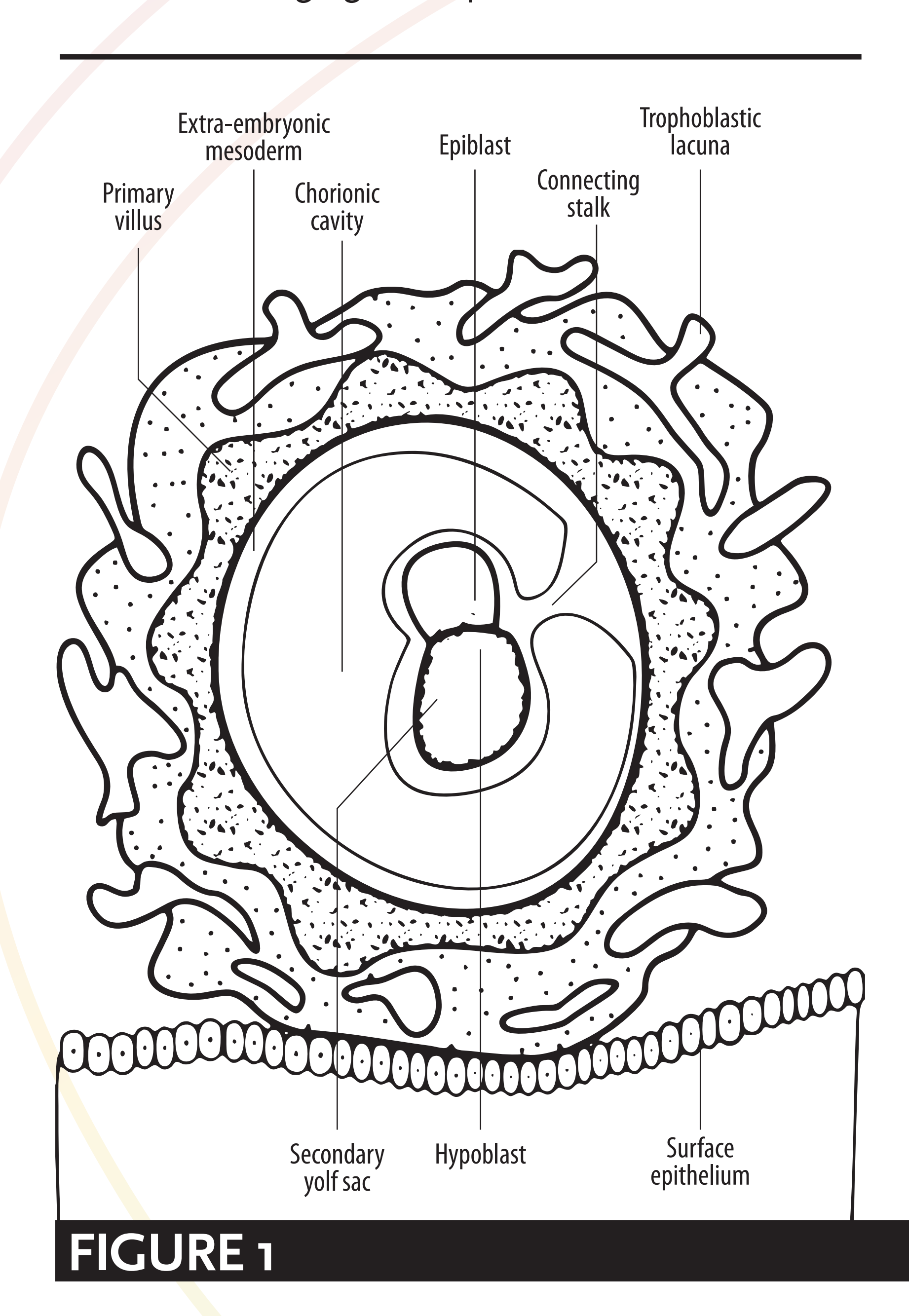


FIGURE 1

OBTAINING NUTRIENTS VIA BLOOD VESSELS

With regard to the way the embryo obtains its nutrients through contact with the maternal blood vessels, Barry Mitchell and Ram Sharma write:

***Due to the rapid growth of the embryo during the second week, there is a need for a more efficient means of nutritional and gaseous exchange. This is achieved when the embryonic blood vessels of the chorion come into contact with the maternal blood vessels of the decidua.*[51]**

***... [by the third week]... The exchange of nutrients, respiratory gases and waste products between the maternal and fetal blood takes place across the placental membrane within intervillous spaces. Maternal blood enters these spaces from the spiral arteries, branches of the uterine artery, bringing nutrients and oxygen for the embryo and fetus.*[52]**

This reinforces the validity of the meanings of *`alaqah,* and its evoking images of an entity obtaining its nutrients via blood.

NEURULATION & THE FOLDING OF THE EMBRYO

The *`alaqah* stage suggests the process of neurulation and the initial stages of the folding of the embryo. Neurulation comprises of the formation of the brain and the spinal cord from days 19 to 25 (approx.); and the folding of the embryo involves the head and the tail being brought closer together. The combination of these two physiological changes causes the embryo to resemble a leech-like substance.

NEURULATION

At the end of neurulation the cranial and caudal ends of the neural tube close. The embryo, at this point, becomes leech-like in appearance [53] [see Figure 2].

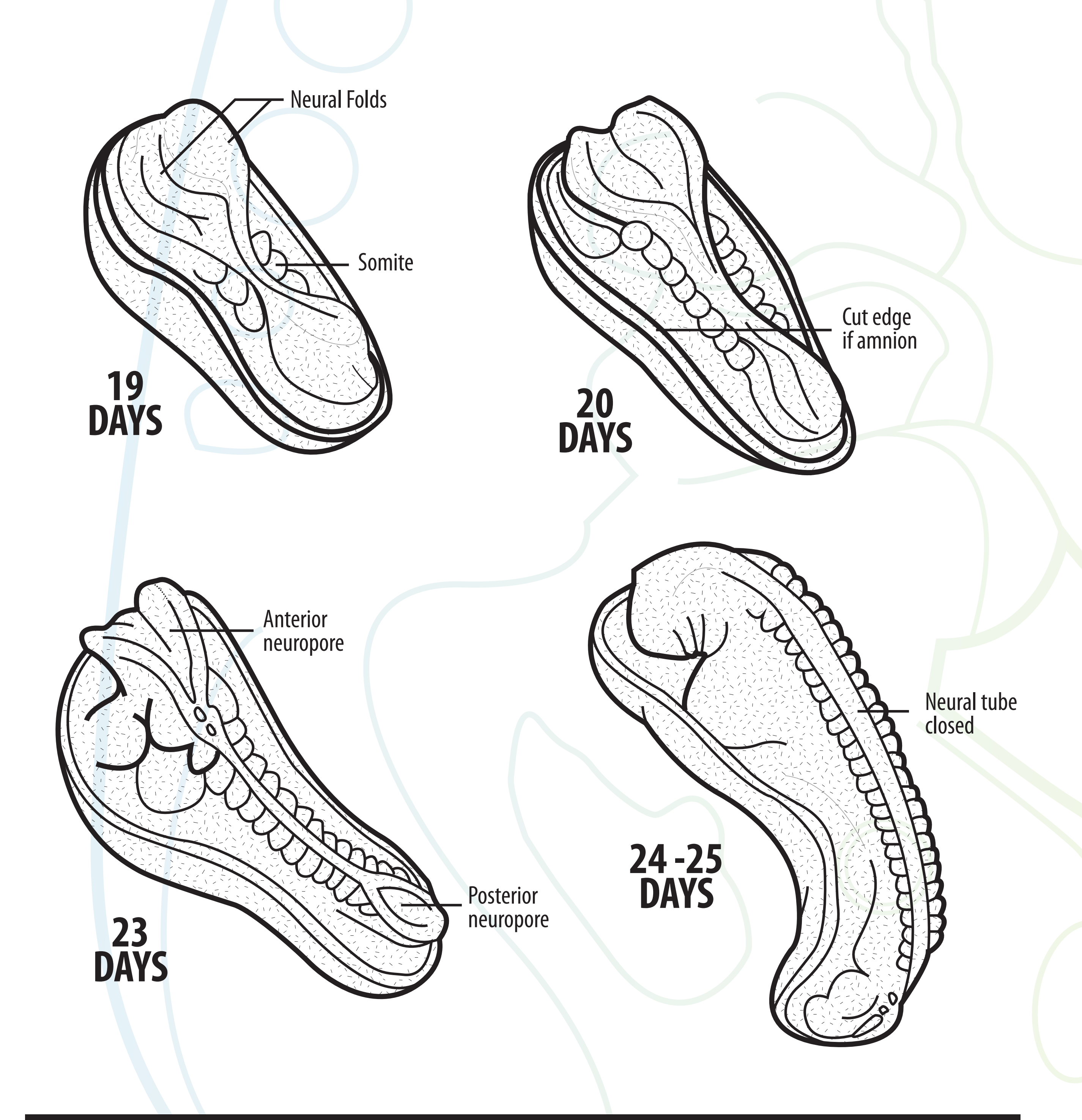


FIGURE 2

Barry Micthell and Ram Sharma explain the process of neurulation:

At about 19 days, at the cranial end of the primitive streak, the underlying mesoderm and notochord induce the ectoderm to form the neural plate, which rounds up to form the neural folds. The neural plate enlarges initially at the cranial end. At 20 days, the neural plate in the mid-region of the embryo remains narrowed, but it expands at the caudal end. The plate deepens to form the neural groove from which the neural tube forms. The cranial and caudal ends of the tube are open and are known as the anterior and posterior neuropores; these eventually close. [54]

FOLDING OF THE EMBRYO

The folding of the embryo is also responsible for forming a leech-like shape [see Figure 3], or as embryologists have described; a cylindric or tube-like structure. Embryologists Keith Moore and T. V. N. Persaud suggest that:

A significant event in the establishment of body form is the folding of the flat trilaminar embryonic disc into a somewhat cylindric embryo. Folding results from the rapid growth of the embryo, particularly the brain and the spinal cord. [55]

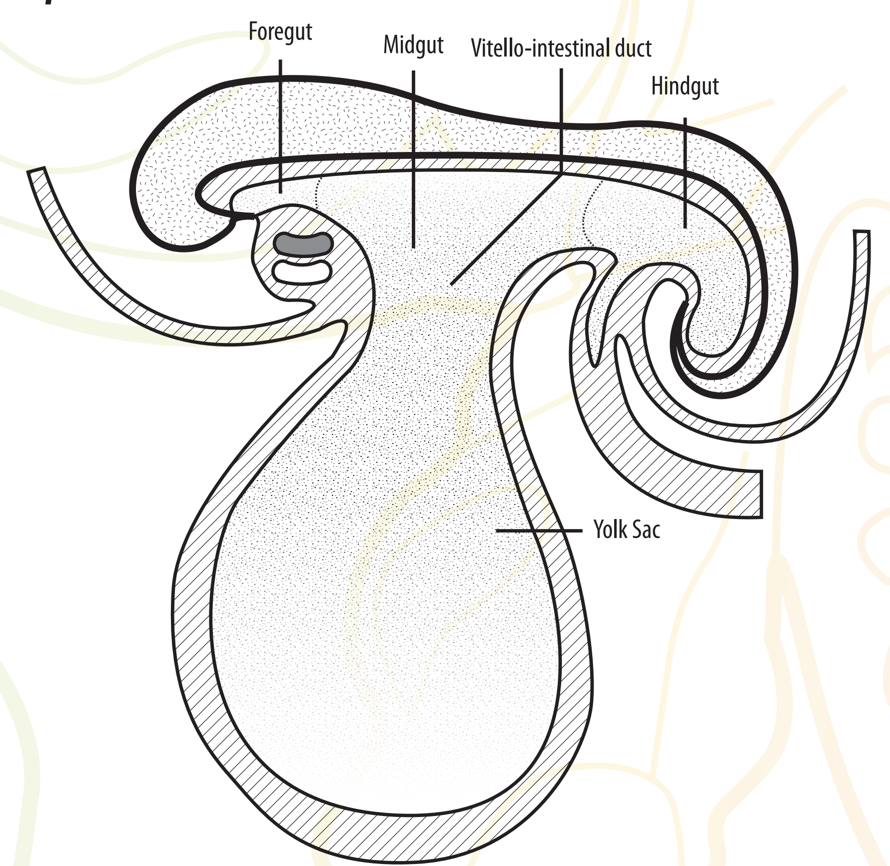


FIGURE 3

The tube-like or leech-like structure [see Figure 4], as explained by Barry Mitchell and Ram Sharma, is due to:

longitudinal folding, which occurs between days 21 and 24, result[ing] in ... the embryo [bending] so that the head and tail are brought closer together...[to] form a tube-like structure. [56]



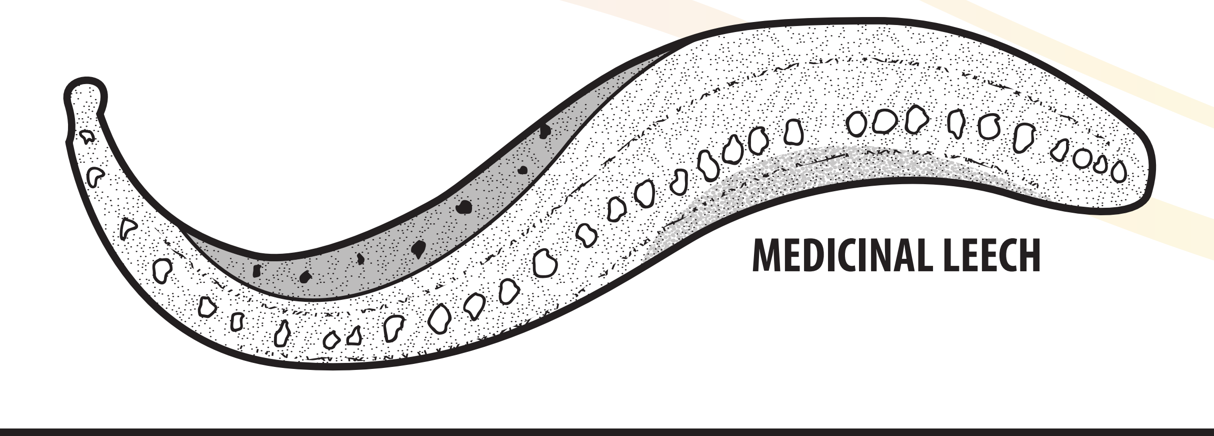


FIGURE 4

SUMMARY

The `*alaqah* stage:

The embryo is connected to the cytotrophoblast via a connecting stalk, as if it were hanging or suspended.

The formation of the brain and the spinal cord, known as neurulation; and during the initial stages of the folding of the embryo. It is upon the culmination of these processes that the embryo appears leech-like.

The embryo obtains its nutrients via contact with the maternal blood vessels. This mirrors the action of a leech-like substance obtaining its nutrients via blood.

GALEN & `ALAQAH

Critics declare that the use of the word `*alaqah* is a description of Galen's second stage of the human embryo. Their translation of the word `*alaqah* to 'blood clot' creates an impression of Galen's description of this stage:

But when it [the clot] has been filled with blood, and heart, brain and liver are still unarticulated and unshaped yet have by now certain solidarity and considerable size, this is the second period; the substance of the foetus has the form of flesh and no longer the form of semen. [57]

There are a number of weaknesses with the implications of these critics:

1. Firstly, the Qur'an does not make a mention of the "***heart, brain and liver ... [being] unarticulated and unshaped yet [with] a certain solidarity and [of a] considerable size".***

2. Secondly, the word `*alaqah* does not mean blood; rather, its primary meanings are 'a clinging form' and 'a leech-like substance'. Some Arab linguists would attribute the meaning of a 'blood clot' to the word `*alaqah*, not because of it being filled with blood, but instead due to it 'clinging' by nature. This interpretation matches the primary meaning of the word.

3. Thirdly, Galen insists ***"the foetus has the form of flesh"*** during the second stage, whereas the Qur'an affirms the *mudghah* (a chewed piece of meat or lump of flesh) stage comes after the `*alaqah* stage.

4. Fourthly and as previously mentioned, similarity doesn't imply plagiarism, and any such accusation requires evidence. The only possible practical link between the work of Galen and the Prophet Muhammad ﷺ is the 7th century physician al-Harith bin Kalada. However, this claim has been dismantled *(see Was al-Harith bin Kalada the source of the Prophet's medical knowledge?)*. In absence of a formal link between Greek medicine and the Prophet ﷺ, the claim of plagiarisation remains speculative and conspiratorial. This is further substantiated by the fact that knowledge of Galen's views on the developing human embryo were not popularised in 7th century Arabia.[58]

MISREPRESENTING THE EMBRYO'S APPEARANCE?

Contemporary commentators argue the embryo only looks leech-like when the yolk sac is removed, and that the `*alaqah's* description is therefore a misrepresentation of the embryo's appearance at this stage. However, embryologists explain that the yolk sac is separated from the embryo by an extra-embryonic feature, called the extra-embryonic coelom. This fact disproves claims of misrepresentation as the yolk sac is not part of the structure of the embryo.[60]

5. A LUMP OF FLESH



and then We made that form into a lump of flesh

The next stage of human development defined in the Qur'an is *mudghah*. This term means to chew, mastication, chewing, to be chewed, and a small piece of meat.[61] [62] It also describes the embryo after it passes to another stage and becomes flesh.[63] Other meanings include something that teeth have chewed and left visible marks on; and marks that change in the process of chewing due to the repetitive act.[64] The *mudghah* stage is elaborated on further, elsewhere in the Qur'an:

then from a fleshy lump (mudghah), formed and unformed. [65]

The Arabic word used here for 'formed' is *mukhallqah* which can also mean 'shaped' or 'moulded'.[66]

SCIENTIFIC INTERPRETATION

Taking a lexical approach to the interpretation of the word, this stage deals with the 4th week, when somites, which resemble tooth-marks [see Figures 5 and 6], begin to develop. The appearance of the embryo at this stage, due to somite development, corresponds with the meanings: 'to be chewed' and 'something that teeth have chewed and left visible marks on'. Concerning somite development, Barry Mitchell and Ram Sharma write:

In the fourth week, the medially placed mesenchymal cells of the somites migrate towards the notochord to form scelerotomes [mesenchyme is the loosely arranged embryonic connective tissue in the embryo].[67]

Another meaning for the word *mudghah* includes something looking like a morsel of flesh. This too is an accurate description of the embryo's appearance at this stage. Interestingly, the qur'anic explanation of *mudghah* as being ***"formed and unformed"***, can refer to the organogenetic period, during which all the main organs have begun to develop, but are not yet fully formed.[68] This period also occurs at around the 4th week.

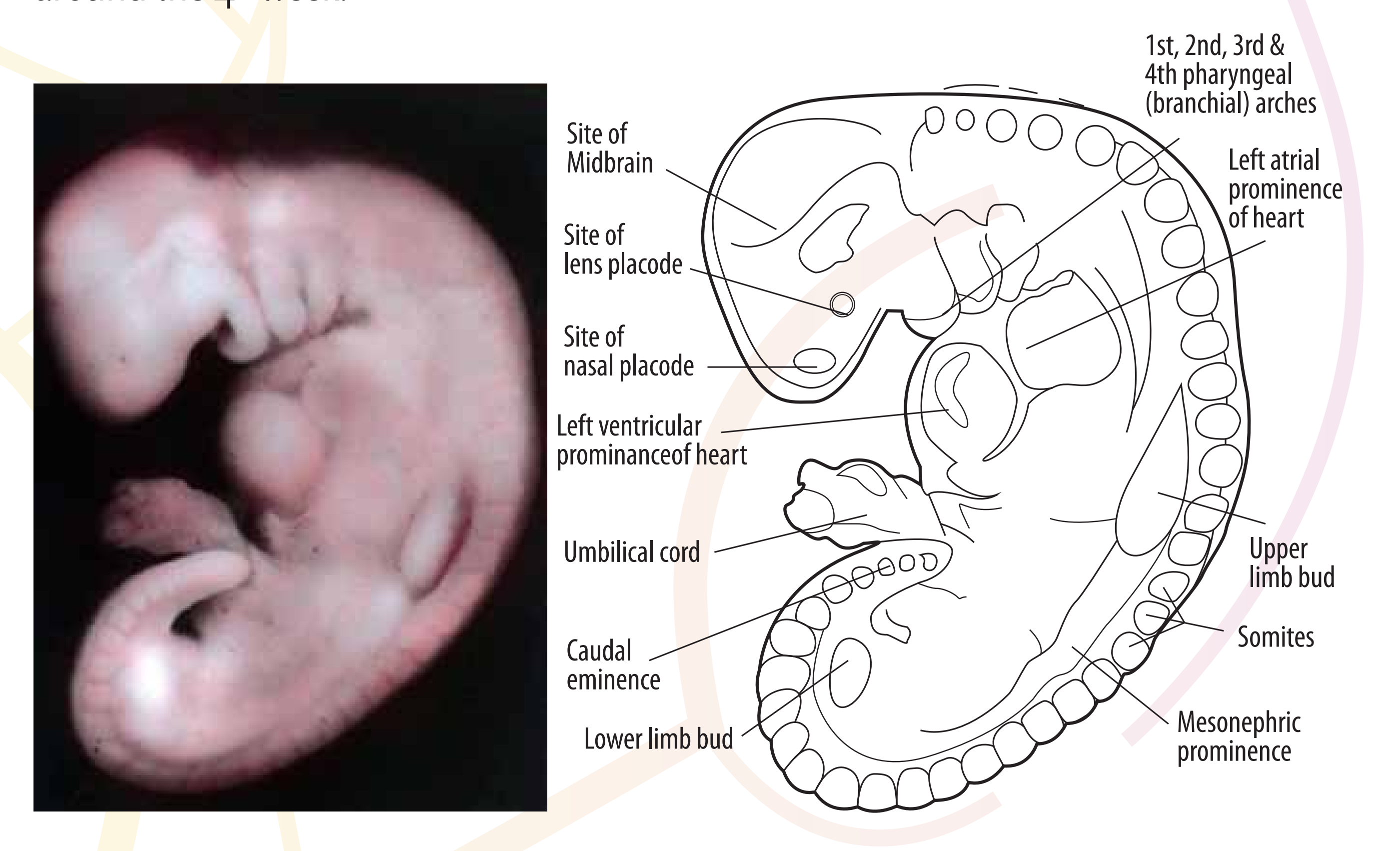


FIGURE 5

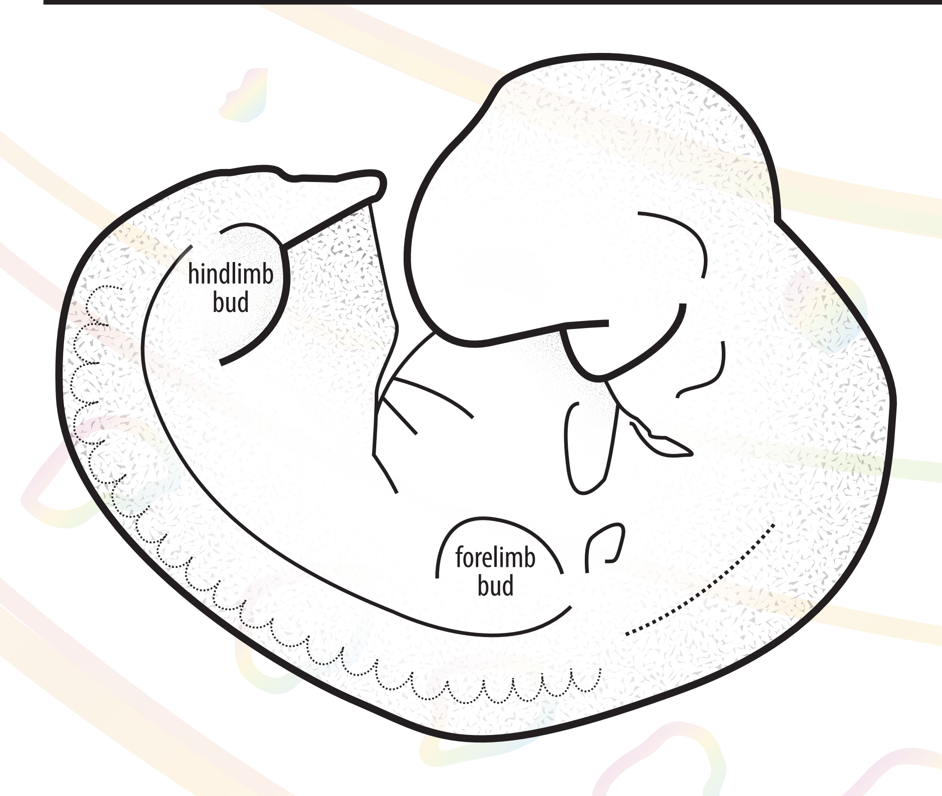


FIGURE 6

A CHEWED SUBSTANCE?

An argument raised by critics concerning the *mudghah* stage is that a chewed piece of meat or a lump of flesh does not resemble the embryo at any stage described by modern embryology. In responding to this, it is necessary to clarify what constitutes a ‘chewed piece of flesh’. It includes, not just mastication, but also something being chewed just the once. This maintains the meaning of the word *mudghah* as the bite marks do resemble a piece of meat chewed once. This is highlighted by its other meaning: ‘something that teeth have chewed and left visible marks on’.

SUMMARY

The `*mudghah* stage:

The development of somites giving the embryo the appearance of a chewed substance.

What looks like a morsel of flesh - an accurate description of embryo's appearance at this stage.

It also describes the organogenetic period (the development of organs, not yet fully formed).

As ever, there have been attempts to compare the qur'anic term *mudghah* with Galen's work to substantiate the view that the Prophet Muhammad ﷺ plagiarised from Greek writings on human development. However, upon analysing Galen's writings, bringing it in contrast to the various and extensive meanings of the word *mudghah*, a pointed difference is made distinct. Galen states:

The third period follows on this, when, as was said, it is possible to see the three ruling parts clearly and a kind of outline, a silhouette, as it were, of all the other parts. You will see the conformation of the three ruling parts more clearly, that of the parts of the stomach more dimly, and much more still, that of the limbs. Later on they form 'twigs', as Hippocrates expressed it, indicating by the term their similarity to branches.[69]

As explored, the Qur'an mentions *mudghah* as a chewed-like substance and a small piece of flesh. In contrast, Galen discusses the ***"conformation"*** of ***"the three ruling parts"***, ***"silhouettes"*** and ***"twigs"***, which is most likely in reference to limb bone formation. He details these three ruling parts as being more visible than the stomach and the limbs. However, the Qur'an makes no mention of this, and its mention of the limb bone formation comes at the next stage. It is both implausible and impractical, therefore, to suggest the Prophet Muhammad ﷺ copied the works of Galen as the Qur'an does not include any of the descriptions provided by Galen at this stage.

6. BONES

فَخَلَقْنَا ٱلْمُضْغَةَ عِظَـٰمًا

and We made that lump into bones

From the *mudghah* stage, `*idhaam* are created. This is the next stage. The word `*idhaam* in the Arabic language means bone, and is specifically applied to the bones of the hands and feet, or of the arms and legs of an animal, upon which is the flesh.[70]

SCIENTIFIC INTERPRETATION

The `*idhaam* stage pertains to the development of the axial and limb skeleton, occuring at around the 5th week. Barry Mitchell and Ram Sharma explain:

The origin of mesenchymal cells forming the skeletal tissues varies in different regions of the body. Mesenchymal cells forming the axial skeleton arise from the mesodermal somites, whereas the bones of the appendicular skeleton are derived from the somatopleuric mesenchyme of the lateral plate mesoderm. After reaching their destination the mesenchymal cells condense and form models of bones. The subsequent differentiation of mesenchymal cells into chondroblasts or osteoblasts is genetically controlled.[71]

'Limb bones' is the specified meaning of the word `*idhaam*, and therefore can refer to the development of the limb buds which give rise to the development of the limbs and the appendicular skeleton. Barry Mitchell and Ram Sharma elaborate on the formation of the limb and appendicular skeleton:

The appendicular skeleton consists of limb girdles and the bones of the limbs. The bones of the appendicular skeleton develop from mesenchymal condensations which become cartilaginous models.[72] [See Figure 7]

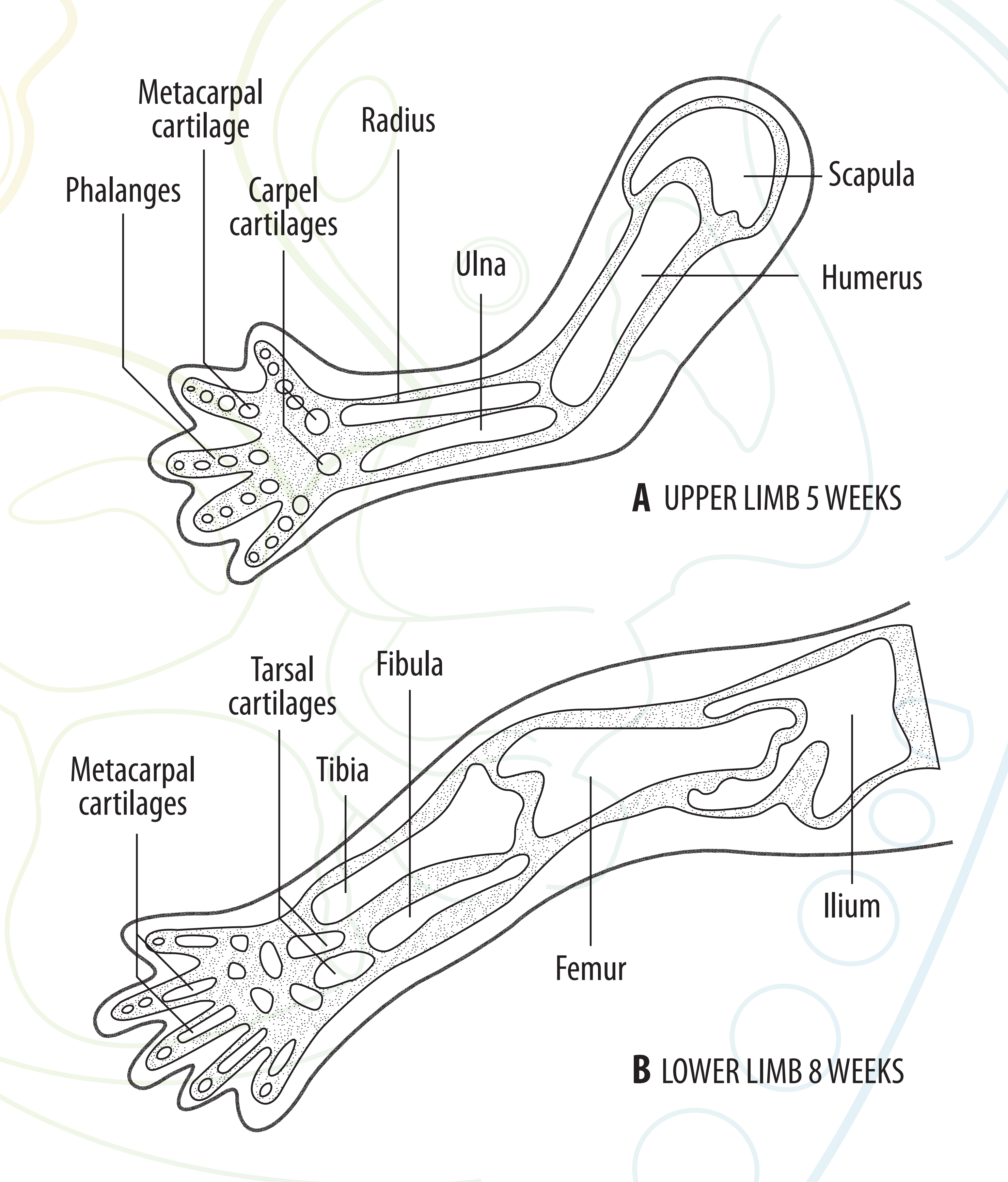

Metacarpal cartilage
Radius
Phalanges
Carpel cartilages
Scapula
Ulna
Humerus
A UPPER LIMB 5 WEEKS
Tarsal cartilages
Fibula
Metacarpal cartilages
Tibia
Ilium
Femur
B LOWER LIMB 8 WEEKS

FIGURE 7

John Allen and Beverley Kramer also comment on limb bone formation,

The limb mesenchyme is at first a homogenous mass but soon condensations occur in it and these chondrify to form cartilaginous models of the various bones. Each cartilage model is surrounded by perichondrium which is a condensation of mesenchyme. An ossific centre (primary ossification centre) is formed upon each cartilage model by the ingrowth of osteobalsts (bone-forming cells) from the surrounding mesenchyme. The surrounding mesenchyme is now termed periosteum (surrounding the bone). Osteoblasts now produce bone which give rise to the skeletal elements of the limbs. [73]

There are clear parallels between the qur'anic *`idhaam* stage and the view modern embryology takes i.e. the development of the axial, limb and appendicular skeleton.

SUMMARY The *`idhaam* stage: The formation of the axial, limb and appendicular skeleton.

FROM A LUMP TO BONES?

A common misconception, usually made by non-Arabists, is that this verse can be literally translated as ***"and We made that lump into bones"***. From this, they conclude that this verse is unscientific because a lump of flesh cannot turn into a mass of bones. However, this is based upon a crude understanding of Arabic grammar and the Qur'an's eloquence. This verse, from a grammatical perspective, has the meanings of: ***"and We made of/from/out of the lump bones".***

This is why Yusuf Ali translates this verse as "***then we made out of that lump bones"***[74]; Shakir translates it as ***"then We made (in) the lump of flesh bones"***; and A J Arberry, in his translation of the Qur'an which is still used by academics today, translates this verse as ***"then We created of the tissue bones"***.[75]

NOT REAL BONES?

Another proposition from commentators is that at this stage there are no real bones. It is argued that the apparent bones are mere cartilage as ossification is incomplete and, as such, the Qur'an must therefore be inaccurate. They further assert that the Arabic term for cartilage should have been used instead of *'idhaam*. Although a valid contention, it is misplaced. The Arabic word for cartilage refers to a type of cartilage that is not a precursor to bones, but rather remains as flexible connective tissue. Also, the *`idhaam* encompasses the cartilaginous form of the bones as the skeletal framework is put in place. Additionally, the process of ossification begins by the 8th week,[76] continuing on after birth, with the eventual completion of the ossification process at around puberty. Barry Mitchell and Ram Sharma explain:

The centres of ossification first appear in the limb bones during the eighth week. By the twelfth week, the shafts of the limb bones are ossified, though the carpal bones of the wrist remain cartilaginous until after birth. The ossification of the three largest tarsal bones of the ankle begins about 16 weeks, but some of the smaller tarsal bones do not ossify until 3 years after birth.[77]

From this perspective, it would be a medical absurdity to assume newborns or young teenagers do not have bones simply because they require ossification, especially since ossification completes at the end of the growth-spurt of puberty. Nevertheless if this were the case, and we are to take this stage as being 'boneless', as it were, the derisions of the word *`idhaam* would allow for an all encompassing interpretation because the ***"cartilaginous models of the various bones"***[78] is included in its meaning.

7. AND WE CLOTHED THOSE BONES WITH FLESH

فَكَسَوْنَا ٱلْعِظَٰمَ لَحْمًا

And we clothed the bones with flesh

The next stage in the qur'anic description of the development of the human embryo is clothing the bones with flesh. The word *kasauna* means: to clothe, to dress, to garb and to attire. It also carries the meanings of: to hang, to drape, to face, to line and to case. Further interpretations of the word include: to incase, to cover, to put, to slip and to give the appearance of and make look like.[79] The word *lahm* means flesh, meat, or a piece of flesh or meat. [80] [81]

SCIENTIFIC INTERPRETATION

The words used in the Qur'an to describe this stage are remarkably consistent with modern embryology. The word *kasauna* denotes the migration and aggregation of the myoblasts which organize into dorsal and ventral muscle masses surrounding the developing skeleton. These physiological developments are illustrated by the meanings *kasauna* carries, such as: to clothe, to dress, to incase and to cover. The word *lahm* is not just limited to the limb muscles but also applies to the muscles masses surrounding the axial skeleton.

Barry Mitchell and Ram Sharma elucidate the process of muscle formation over the developing limb skeleton:

The limb muscles differentiate from myoblasts in the proximal part of the limb bud, and soon receive their innervations from the ventral rami of the spinal nerves. The myoblasts then migrate distally and soon become organized into a dorsal and ventral muscles mass surrounding the developing skeleton, carrying their innervations with them.[82]

John Allen and Beverley Kramer confirm how limb muscles are formed:

Soon after the cartilaginous models of the bones have been established, the myogenic cells, which have now become myoblasts, aggregate to form muscle masses on the ventral and dorsal aspects of the limbs. These muscle masses, the relevant compartments, form the flexors and extensors of the joints. Rotator muscles are also formed so that flexors and pronators are related and extensors and supinators are related.[83]

The process of muscular formation is not just limited to the limbs. Once the skeletal framework is in place, muscles start to form around the developing skeleton. For example, embryologist Bruce Carlson highlights how the facial musculature forms once the basic facial skeletal structure takes place.[84]

SUMMARY *Kausana* and *lahm* (the key words in this stage): the migration and aggregation of the muscles cells around the developing limb and axial skeleton, to form muscles, tendons and connective tissue.

ARISTOTLE & MUSCLE FORMATION

Academic historians attest the Prophet Muhammad ﷺ plagiarised this stage from the Greek Philosopher Aristotle. Artistotle's following statement ***"Round about the bones, and attached to them by thin fibrous bands, grow fleshy parts, for the sake of which the bones exist"*** [85] seems to correlate with the qur'anic statement ***"then we clothed the bones with flesh"***.

An interesting and significant perspective can be taken considering the similarities between both these statements. Rather than negate the authenticity of the Qur'an, it serves to dismantle the claims that the Prophet Muhammad ﷺ copied Aristotle. What is primarily brought to mind is the question of how, if the Prophet ﷺ is supposed to have taken from Aristotle's work, is it the Qur'an only contains the correct information and refused to include Aristotle's incorrect information?

In exploring the above question further problems with the plagiarisation thesis are brought to light, which inevitably prove the credibility and authenticity of the Qur'an. For example, how can we explain the Prophet ﷺ not adopting the Aristotelian view that male embryos are generated on the left side of the womb, and female embryos on the right side of the womb? [86] Or the fact that the Qur'an does not mention Aristotle's discredited and misapplied theory of semen mixing with women's menstrual blood

coagulating to form the embryo? And what caused the distinction between the Qur'an's specification of *nutfah* instead of *haydh* (menstrual blood) during the stage of fertilization? Moreover, Aristotle held the belief that the upper body is formed before the lower body:

Now the upper portion of the body is the first to be marked off in the course of the embryo's formation; the lower portion receives its growth as time goes on.[87]

Again, this is a concept the Qur'an does not mention.

If the claim that Aristotle was plagiarised is to be taken seriously we must ask a final question: why, when there was no scientific way of proving or disproving Aristotle's statements as true, does the Qur'an choose to specifically omit these wrong conjectures? As such, it is apparent these contentions are irrational and probabilistic, and suffer from a lack of explanatory power and scope. The likeness between both statements is a means to deconstruct the plagiarisation thesis, as it is based on the extreme and infinitesimal probability that the Prophet Muhammad ﷺ would take the correct information, at the same time find more concise words to describe the process, reject the incorrect information and include other aspects of the process not mentioned in Greek literature.

WHY USE FLESH AND NOT MUSCLE?

Critics of the qur'anic description of the developing human embryo maintain that the word *lahm* (flesh) is not the most accurate word to use and the word *adlat* (muscle) is more appropriate. This approach is insubstantial because the word *lahm* is far more comprehensive. It includes muscle and other aspects of flesh such as tendons and connective tissue in its meaning, all of which are involved at this stage. John Allen and Beverley Kramer explain this stage:

Ultimately, the muscles and tendons become attached to the bony structures so that they can produce their actions across the joints.[88]

This statement proves the imposition against *lahm* to be ineffective. Simply specifying 'muscle' would not be comprehensive enough to describe what occurs at this stage.

WHAT WAS CREATED FIRST, BONES OR FLESH?

Commentators on the qur'anic description of the developing human embryo claim the Qur'an portrays an inaccurate succession of events with regards to the bones and the clothing of the flesh. They declare bone and muscle formations occur simultaneously, but the Qur'an uses the connective particle *fa*, which in the context of the verse, indicates a quick succession of one thing happening after the other. For instance the Qur'an says ***"We made that lump into bones, and (fa) We clothed those bones with flesh".***

This view represents a misunderstanding of the linguistic context of the verse. The Qur'an's use of the particle *fa* is not in the context of creating; rather it is in the context of clothing the bones with flesh. The Qur'an does not specify when the flesh (or muscles) were formed; it only specifies

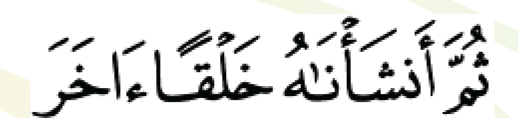
when the clothing of the limb bones with flesh happens. This, as John Allen and Beverley Kramer explain, is straight after:

Soon after the cartilaginous models of the bones have been established, the myogenic cells, which have now become myoblasts, aggregate to form muscle masses on the ventral and dorsal aspects of the limbs. [89]

A significant clarification to make is that this contention has no scientific basis because limb bone and muscle formation are not simultaneous. Embryologist Bruce Carlson confirms the limb bones as being formed before the limb muscles:

The skeleton is the first major tissue of the limb to show overt signs of differentiation. [90]

8. WE MADE HIM INTO OTHER FORMS



Then we made him into other forms

The word *khalqan* means to shape, to form and to mold. It also means to make, to create and to originate.[91] The word *akhara* means another or one more.[92] Al-Razi quotes the companion of the Prophet ﷺ, and qur'anic exegete, Ibn Abbas that 'other forms' signifies all various types of growth including foetal, infancy, and childhood. [93]

SCIENTIFIC INTERPRETATION

The terms used in the Qur'an to describe the final process correspond to modern embryology. From the 8th week to the end of pregnancy the period of growth and enlargement occurs, during which time the baby begins to form human-specific aesthetic features. This is usually called the foetal stage. The baby's 'shape' develops from indistinguishable to being 'molded' and 'made to look like' the human 'form'. Barry Mitchell and Ram Sharma convey this stage of growth:

The period of time from the end of week 8 to full term (38 weeks) is a phase of growth and enlargement (the fetal period).[94]

SUMMARY The *khalqan akhara* stage: The end of the embryonic stage, and the beginning of a new phase of growth.

WAS AL-HARITH BIN KALADA THE SOURCE OF THE PROPHET'S MEDICAL KNOWLEDGE?

The physician al-Harith bin Kalada was born in the middle of the 6th century in the tribe of Banu Thaqif in Ta'if. Some historians maintain that he received his medical education at the Jundishapur medical school where he learnt the teachings of Aristotle and Galen.[95] According to these historians:

The major link between Islamic and Greek medicine must be sought in late Sasanian medicine, especially in the School of Jundishapur rather than that of Alexandria. At the time of the rise of Islam Jundishapur was at its prime. It was the most important medical centre of its time, combining the Greek, Indian and Iranian medical traditions in a cosmopolitan atmosphere which prepared the ground for Islamic medicine.[96]

Following this narrative some historians and commentators believe the Prophet Muhammad ﷺ plagiarised Aristotle's and Galen's accounts of the developing human embryo via bin Kalada, and sought medical advice from him.[97] This is unfounded for various reasons.

1. As previously explored, if the Prophet ﷺ had indeed been influenced by bin Kalada's knowledge of the Greek physicians, how did he specifically reject what was wrong, improve what was right, and add new stages or parts of the processes, of which all are corroborated by modern embryology?

2. Claiming the Prophet ﷺ sought medical advice from bin Kalada neither implies nor stipulates the fact that he copied bin Kalada's work. The onus of proof is on the one who is making the claim. From a historical perspective there is no direct and explicit evidence that indicates the Prophet ﷺ manufactured his views on embryology via bin Kalada.

3. Early historical sources on the Prophet's ﷺ life illustrate and emphasise the integrity of his character. He was not a liar and to assert as much is indefensible. The presumption that he copied bin Kalada, while maintaining the Qur'an to be the word of God, is therefore inconceivable. He was known even by the enemies to his message as the ***"Trustworthy"***.[98]

Further proof of the Prophet's ﷺ reliability and credibility is enforced and substantiated by the fact that a liar usually lies for some worldly gain, but the Prophet ﷺ rejected all worldly aspirations, and suffered tremendously for his message. He rejected the riches and power he was offered to stop promulgating his message.[99] Significantly, he was persecuted for his beliefs; boycotted and exiled from his beloved city, Makkah; starved of food; and stoned by children to the point where his blood drenched his legs. His wife passed away and his beloved companions were tortured and persecuted.[100] The late Emeritus Professor in Arabic and Islamic Studies, W. Montgomery Watt in *Muhammad at Mecca* explores this:

His readiness to undergo persecution for his beliefs, the high moral character of the men who believed in him and looked up to him as a leader, and the greatness of his ultimate achievement - all argue his fundamental integrity. To suppose Muhammad an impostor raises more problems than it solves.[101]

4. It is generally believed that bin Kalada graduated from the Persian medical school at Jundishapur. However, the existence of such a school has recently been questioned by a number of leading historians. For instance David C. Lindberg in his book *The Beginnings of Western Science* highlights the legendary status of the school:

An influential mythology has developed around Nestorian activity in the city of Gondeshapur [Jundishapur] in south-western Persia. According to the often-repeated legend, the Nestorians turned Gondeshapur into a major intellectual center by the sixth century, establishing what some enthusiasts have chosen to call a university, where instruction in all of the Greek disciplines could be obtained. It is alleged that Gondeshapur had a medical school, with a curriculum based on Alexandrian textbooks, and a hospital modeled on Byzantine hospitals, which kept the realm supplied with physicians trained in Greek medicine. Of greatest importance, Gondeshapur is held to have played a critical role in the translation of Greek scholarship into Near Eastern languages and, indeed, to have been the single most important channel by which Greek science passed to the Arabs. Recent research has revealed a considerably less dramatic reality. We have no persuasive evidence for the existence of a medical school or a hospital at Gondeshapur, although, there seems to have been a theological school and perhaps an attached infirmary. No doubt Gondeshapur was the scene of serious intellectual endeavour and a certain amount of medical practice —it supplied a string of physicians for the Abbasid court at Baghdad beginning in the eighth century— but it is doubtful that it ever became a major center of medical education or of translating activity. If the story of Gondeshapur is unreliable in its details, the lesson it was meant to teach is nonetheless valid. [102]

Roy Porter, a social historian of medicine, raises the contention if whether a medical school actually existed there. Porter in his book *The Greatest Benefit to Mankind: A Medical History of Humanity* writes:

Jundishapur was certainly a meeting place for Arab, Greek, Syriac and Jewish intellectuals, but there is no evidence that any medical academy existed there. Only in the early ninth century did Arab–Islamic learned medicine take shape. [103]

5. Historians such as Manfred Ullman and Franz Rosenthal are skeptical about the material referring to bin Kalada. They refer to him as a legendary figure[104], which has literary allusions to characters of fictitious creation. Professor Gerald Hawting, in his essay *The Development of the Biography of al-Harith ibn Kalada and the Relationship between Medicine and Islam*, writes:

In these latter sources the information about al-Harith is fragmentary, references to his profession as a doctor are not consistent and, where they occur, tend to be incidental, and there seems to be little information about the nature of his medicine or detail about his life.[105]

From this perspective, using unreliable or inconclusive historical narratives concerning bin Kalada's "profession as a doctor" serve to weaken the argument that the Prophet ﷺ copied the 7th century physician.

6. There appears to be no evidence of a major medical school in either the 6th or 7th century. The academic medic and historian Plinio Prioreschi in his book *A History of Medicine* highlights that there are no Persian sources that substantiate the claim that Jundishapur played a significant role in the history of medicine.[106]

7. There are historical reports stating that bin Kalada converted to Islam and was considered a companion of the Prophet ﷺ. Ethnographer and linguist, William Brice in his book *Historical Atlas of Islam*, writes:

He was converted to Islam and had acquired the status of one of the Prophet's Companions.[107]

Lecturer and novelist, Abubakr Asadullah expresses a similar position:

According to nearly all traditional sources, the first known Arab physician was al-Harith ibn Kalada, a graduate of Junishapur and a Jewish convert to Islam, a contemporary of Prophet Mohammad.[108]

In light of this, the Prophet ﷺ copying bin Kalada is highly improbable as it is irrational to assert that an educated physician would convert to Islam, and follow the Prophet's ﷺ message, had he known or suspected the Prophet ﷺ of copying his work on embryology. However, it must be noted that there is uncertainty as to whether bin Kalada embraced Islam and reports relating to his conversion are not authentic. [109]

8. The traditional sources that elaborate on bin Kalada also convey information relating to the Prophet ﷺ, including his miracles and the supernatural eloquence of the qur'anic discourse. One of these sources is *Ta'rikh al-Rusul wa'l-Muluk* [110]. It underlines various aspects of the life and character of the Prophet ﷺ including his truthfulness. Since this source is used for sound historical information, insight, and as a point of reference on bin Kalada, reason necessitates that it also be viewed as reliable with regard to its discussion on the unquestionable integrity of the Prophet ﷺ. Therefore, to accept the historical sources that elaborate on bin Kalada would be tantamount to accepting the truthfulness of the Prophet ﷺ, thereby undermining any claim of copying and plagiarisation.

9. Bin Kalada was from al-Ta'if, a town which came into contact with Islam only in the 8th year of the Islamic calendar, and it was during this period that Islamic historical sources first mention the phycisian. Therefore, it would be impossible to suggest the Prophet Muhammad ﷺ copied Bin Kalada's views on the developing human because chapter 23 of the Qur'an and its verses referring to embryology had already been revealed by the time Bin Kalada met the Prophet Muhammad ﷺ.[111]

10. The link between bin Kalada and the Hellenistic tradition is doubted by historians. Gerald Hawting explains that due to the scientific tradition in the Golden Age, historians and biographers of the time sought links to established institutions such as Jundishapur, to associate Islam with the science of the day:

In this context... [Hawting sees]... a motive for the elaboration of the links of al-Harith ibn Kalada with Persia and its Hellenistic tradition. [112]

In view of this, whether bin Kalada had any formal link to Galen's and Aristotle's view on the development of the human embryo remains inconclusive and so adopting the plagiarisation thesis via bin Kalada does not carry much weight. For a lengthy discussion on this topic please refer to Khalid al-Khazaraji's and Elias Kareem's essay *Was al-Harith bin Kaladah the Source of the Prophet's Medical Knowledge.* [113]

DID THE PROPHET DISSECT HUMAN AND ANIMAL EMBRYOS?

Critics allege that the Prophet Muhammad ﷺ dissected or examined human and animal embryos, and therefore serves as an explanation of his scientific knowledge. An immediate refutation of this allegation is that many of the stages described in the Qur'an cannot be seen with the naked eye but require optical aids, examples of which include the *nutfah* stage and the *`alaqah* stage. Yet another poignant reason invalidating this is the impracticalness and counter-productivity of the Prophet ﷺ spending his time examining embryos, when his proclaimed mission was to spread the message of Islam. These particular verses (that is; the verses detailing the development of the embryo) did not, and would have been unlikely to, affect the essence or propagation of Islam, especially in a 7th century Arabian context where such deep understandings of embryology was improbable. Finally, why aren't there any records of the Prophet ﷺ dissecting animal or human embryos? Such a claim does not tally with the life and mission of the Prophet Muhammad ﷺ.

IS THE QUR'AN INACCURATE CONCERNING WHERE SPERM COMES FROM?

So let man observe from what he was created. He was created from a fluid, ejected, emerging from between the backbone and the ribs.[114]

The above verses have been condemned by various critics and commentators as being scientifically inaccurate, and any attempt to salvage an accurate meaning from them has been suggested to be tantamount to textual acrobatics. This evaluation arises from an analysis of the words ٱلصُّلْبِ *(sulb)* ٱلتَّرَآئِبِ؛ *(tara'ib)* which

have been translated to mean ‘backbone’ and ‘ribs’. Those who maintain the scientific inaccuracy of the Qur’an claim the above translation for the words *sulb* and *tara’ib* cannot be reconciled with modern developments in physiology. However, after a lexical analysis of these words it will be seen that these words do in fact concur with modern physiology.

The word ٱلصُّلْبِ *(sulb)* carries various meanings including hard, firm, solid, stiff and rigid. It also means any portion of the backbone, particularly the lumbar portion and the loins. It is specific to males[115][116]. The word ٱلتَّرَآئِبِ *(tara’ib)* means breastbone, the ribs[117] or the pelvic arch[118], and this word according to most authors refers specifically to women.

With such examinations of the interpretations offered by the Arabic language, it can be inferred that the Qur’an complies with modern physiology as it is well known that the sperm and semen come from an area referred to as the loins, and the ovum comes from the pelvic arch area. Both of which are required for the creation of man, that is to say, the human being.

DO THE PROPHETIC TRADITIONS UNDERMINE THE SCIENTIFIC ACCURACY OF THE QUR’AN?

Prophetic traditions that clarify and elucidate the qur’anic view on the developing human embryo correspond with modern embryology. There are a myriad of traditions that substantiate this claim. For instance the following tradition on gender determination highlights how the Prophetic traditions are in line with scientific developments:

The angel is sent to the nutfah after it has settled in the uterus for 40 or 45 nights and says, “Lord! Is it to be wretched or happy?” Then this is inscribed. Then he says, “Lord! Is it to be male or female? [119]

During the 6th week of the developing embryo the primary sex cords are finger like projections. At this time both the male and female gonads appear identical. However, just after the 6th week a significant event occurs that determines the physical expression of the embryo's genetic make up. This event is the activation of genes that stimulates the production of male and female hormones:

If the Y chromosome is present in the embryo's cell, a gene within the short arm of the chromosome called SRY will turn on, initiating a chemical chain reaction that will turn on other genes and stimulate the production of male hormones. If the X chromosome is present, or if the SRY gene is missing from the Y chromosome, the embryo will develop into a female via mechanisms that are not fully understood.[120]

This clearly shows a strong correspondence between embryology and the above tradition.

However, there is a particular tradition that critics have claimed to be scientifically inaccurate. The following tradition has been interpreted to mean that the *nutfah*, *`alaqah* and *mudghah* stages occur in three 40 day sequences, making it a period of 120 days. This interpretation does not concur with the appearance of the embryo during this time:

The Messenger of Allah, the true and truly inspired said, "(The matter of the Creation of) a human being is put together in the womb of the mother in forty days, and then he becomes a clot of thick blood for a similar period, and then a piece of flesh for a similar period.[121]

To clarify this seemingly inaccurate tradition, a correct interpretation would be that the 40 days are parallel, meaning that the stages occur within a 40 day period. This is supported by another Prophetic tradition which mentions that the creation of specific differentiated organs start after the first 42 days:

When 42 nights have passed...God sends an angel to it, who shapes it.[122]

This tradition clearly indicates that the *nutfah, `alaqah* and *mudghah* stages occur before 42 days.

Additionally, the tradition in question uses the phrase ‘like that’ which can be understood as a repetition of the time period. The phrase is *mujmal*, which in the classical sciences means general, whereas the aforementioned tradition is *mubayyan*, meaning explicit. The rule according to the classical sciences is that the general is specified by the explicit to give an accurate portrayal of the meaning and intention of the speaker. Many scholars such as Imam Malik and the 7th century scholar Ibn Azzamlakani reached the conclusion that the *nutfah, `alaqah* and *mudghah* stages occur during the first 40 days.

A NOTE ON USING TRANSLATIONS

Various critics who argue the aforementioned verses (i.e. on embryonic development and the origins of sperm) are not in line with scientific facts, tend to use the available qur’anic translations to express and highlight how certain words in the Qur’an cannot be reconciled with scientific truths. This approach is flawed. Translation studies conclude that there can never be equivalence between languages[123], and to assert this would wrongfully presume cultural and linguistic symmetry between two different languages, which is linguistically unattainable. This clarification is applicable more so to Arabic and European languages than any other as they are both ***“linguistically and culturally incongruous”.***[124] Therefore, a translation will never be a representation of the original text and anyone who seeks total equivalence ***“is chasing a mirage”.***[125] Hence, a lexical analysis, coupled with an understanding of qur’anic exegesis and up-to-date knowledge of modern science, is required to form sound conclusions concerning science and the Qur’an.

In attempts to close the gap between languages a detailed exploration is required of the derivations and connotations of each and every word. As a result of this, translators produce numerous translations of a

single verse. Additionally, translations are heavily dependent on exegetical works and the wide range of interpretations offered by them. Citing one particular translation or restricting the evidence for points of an argument to a single interpretation does not allow for, and cannot provide, adequate grounds for reaching a proposed conclusion. With regard to verses concerning natural phenomena, interpretations will vary based upon the background information a particular exegete has on the topic. Evidently, basing conclusions on inaccurate interpretations and translations is an insubstantial and ineffectual means of inferring the Qur'an is wrong. If all possible meanings of a particular verse were reconciled with knowledge of the natural world, and the results showed them to be incongruous and incompatible, then the conclusion of the Qur'an as inaccurate would be taken seriously. As yet, this has not been the case as illuminated, established and reaffirmed with the analysis provided in this paper.

On a more general note, the linguistic features of qur'anic Arabic give the Qur'an depth. Its use of words with multi-layered meanings facilitates oceans of interpretations, providing the foundations and impetus for one of the world's greatest and most influential civilizations. As the academic linguist Hussein Abdul-Raof writes:

The richness of qur'anic language and its receptivity towards different interpretations help explain how this single book could have given shape to one of the world's great civilizations. [126]

CONCLUSION

This paper proposed a scientific-linguistic analysis of chapter 23 verses 12 to 14 of the Qur'an. Modern medical references were used to correlate between significant linguistic details and contemporary science. The results clearly illustrate the Qur'an as being concurrent with modern embryology. Additionally, contentions to the qur'anic view on the development of the human embryo were responded to with particular emphasis on the plagiarisation thesis, which puts forward the charge that the Prophet Muhammad ﷺ copied Galen and Aristotle. The responses provided expose the plagiarisation thesis as untenable, and lacking in explanatory power and scope.

It is hoped that this paper will open the door for sincere, nuanced and frank discussions concerning the qur'anic discourse. It must be understood that in order to comprehend the Qur'an, a deep study is required rather than a superficial reading of its verses. Take the analogy of a vast sea. Swimming on the surface will never give scientists knowledge of its secrets.

Similarly, concerning the depth of the Qur'an, God makes this clear:

And if whatever trees upon the earth were pens and the sea [was ink], replenished by thereafter seven more seas, the words of God would not be exhausted. Indeed, God is Exalted in Might and Wise.[127]

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GLOSSARY

Amnioblast: a cell derived from the ectoderm which forms the wall of the amniotic cavity, i.e. the amnion.

Amniotic cavity: the cavity surrounded by the amnion, filled with amniotic fluid, surrounding the foetus.

Blastocyst: the hollow sphere of cells derived from the morula consisting of the inner cell mass and outer trophoblast.

Cartiliginous plate: the growth plate in a developing long bone.

Chorion: the membrane that surrounds the foetus, consisting of trophoblast and extra-embryonic mesoderm.

Chorionic villi: the finger like protrusions of chorion and trophoblast which contain blood vessels, and are surrounded by maternal blood in the intervillous spaces.

Cytotrophoblast: the cellular part of the trophoblast, as distinguished from the syncytiotrophoblast.

Ectoderm: the outer germ cell layer that gives rise to the epidermis of the skin, the nervous system and sense organs.

Endoderm: the inner germ cell layer from which the lining of the gut tube and its associated glandular structures are derived.

Endometrium: the inner lining of the uterus in which implantation occurs.

Extra-embryonic coelom: the space between the layers of the extra-embryonic mesoderm; also known as the chorionic

activity; and separates the amnion and yolk sac from the embryo.

Foetal period: the period of growth in size of the foetus from week 8 to term.

Mesenchyme: loose embryonic connective tissue derived from mesoderm or neural crest.

Myoblast: precursor cells of muscles, derived from intra-embryonic mesoderm.

Neurulation: the process of neural tube formation.

Notochord: the midline structure that forms a midline axis for the embryo, and from which the intervertebral discs are formed.

Scelerotome: derived from the somite and giving rise to connective tissue surrounding the neural tube and notochord to form the vertebrae.

Somites: most medial segmented components differentiated from the paraxial mesoderm and giving rise to muscle of the trunk and limbs, most of the axial skeleton and part of the dermis.

Syncytiotrophoblast: the outer part of the trophoblast that invades the endometrium and which contributes to the formation of the placenta.

Trophoblast: cells that form the outer layer of a blastocyst which provide nutrients to the embryo and develop into a large portion of the placenta.

Zygote: is the initial cell formed when two gamete cells are joined by means of sexual reproduction. These cells are an ovum from the female and a sperm cell from the male.

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